Deformation of Alumin at High Pressure and High Temperature	X17B1

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To investigate the deformation mechanism and develop flow law in alumina at high pressure and temperature up to 10 GPa and 1500 K, stress relaxation experiments have been carried out on alumina with a grain size of $<$ 5 micron using a DIA-type multi-anvil high-pressure apparatus. Strain (stress)-time at a constant pressure and a constant sample volume has been *in situ* measured by the analysis of synchrotron x-ray diffraction peak broadening. The most remarkable result is that there is a dramatic drop in internal stress from 8 to 2 GPa as the temperature increases from 700 to 1200 K. Three deformation behaviors can be identified by the stress and temperature regimes. At the high stress ($>$ 8 GPa) and the low temperature ($<$ 700 K) region, stress exponent n is larger than 20 and the activation energy U is lower than 50 kJ/mol. In this region, the strain rate is very low. The internal stress is about 8 - 10 GPa, relatively insensitive to temperature. At the intermediate stress (2 $\sim$ 6 GPa) and temperature (700 $\sim$ 1200 K) region, n is about 5 - 20 and it decreases with increasing temperature. U is 150 - 200 kJ/mol and decreases with increasing stress. At the low stress ($>$ 2 GPa) and high temperature ($>$ 1200 K) region, n is smaller than 5. The internal stress is about 1- 2 GPa. We propose that a large stress drop between 700 and 1200 K is associated with a softening and flow process controlled by a vigorous thermal activation of dislocation over short-range barriers, either Peierls resistance, or discrete obstacles. Below 1200 K, the stress relaxation is due to dislocation glide. Above 1200 K, the stress relaxation process is dislocation climb regime.